

## Claims

- [c1] A trench storage structure comprising:  
a substrate having a trench;  
a capacitor conductor in a lower part of said trench;  
a doped trench top oxide in said trench above said capacitor conductor; and  
a conductive buried strap in said substrate adjacent said trench top oxide.
- [c2] The structure in claim 1, wherein said doped trench top oxide and said conductive buried strap have the same doping impurity.
- [c3] The structure in claim 1, further comprising an undoped trench top oxide in said trench above said doped trench top oxide.
- [c4] The structure in claim 3, further comprising a gate conductor in said trench above said undoped trench top oxide layer, wherein said undoped trench top oxide layer insulates said gate conductor from said capacitor conductor.
- [c5] The structure in claim 1, wherein a percentage by weight of dopant in said doped trench top oxide is less than 1%.
- [c6] A trench storage structure comprising:  
a substrate having a trench;  
a capacitor conductor in a lower part of said trench; and  
a trench top oxide in said trench above said capacitor conductor, wherein said trench top oxide includes:  
a doped trench top oxide layer; and  
an undoped trench top oxide layer above said doped trench top oxide layer.
- [c7] The structure in claim 6, further comprising a conductive node strap in said trench adjacent said capacitor conductor.
- [c8] The structure in claim 6, further comprising a conductive buried strap in said substrate adjacent said trench top oxide.
- [c9] The structure in claim 8, wherein said doped trench top oxide layer and said conductive buried strap have the same doping impurity.

- [c10] The structure in claim 6, further comprising a gate conductor in said trench above said undoped trench top oxide layer, wherein said undoped trench top oxide layer insulates said gate conductor from said capacitor conductor.
- [c11] The structure in claim 6, wherein a percentage by weight of dopant in said doped trench top oxide layer is less than 1%.
- [c12] A method of forming a memory device, said method comprising:  
patterning a trench in a substrate;  
filling a lower portion of said trench with a capacitor conductor;  
forming a doped trench top oxide in said trench above said capacitor conductor; and  
heating said structure to form a conductive buried strap in said substrate adjacent said trench top oxide.
- [c13] The method in claim 12, wherein said process of depositing said doped trench top oxide comprises a high density plasma-chemical vapor deposition (HDP-CVD) process.
- [c14] The method in claim 12, wherein said process of depositing said doped trench top oxide comprises the following parameters:  
deposition rate of silane reactant gas flow 10 – 75 sccm;  
approximate bias plasma power 300 B 1000 W; and  
phosphine gas delivery at gas flows below 5 sccm.
- [c15] The method in claim 12, wherein during said process of depositing said doped trench top oxide layer, a percentage by weight of dopant in said doped trench top oxide layer is less than 1%.
- [c16] The method in claim 12, further comprising depositing an undoped trench top oxide in said trench above said doped trench top oxide.
- [c17] The method in claim 16, further comprising depositing a gate conductor in said trench above said undoped trench top oxide layer, wherein said undoped trench top oxide layer insulates said gate conductor from said capacitor conductor.
- [c18] A method of forming a memory device, said method comprising:

patterning a trench in a substrate;  
filling a lower portion of said trench with a capacitor conductor; and  
forming a trench top oxide in said trench above said capacitor conductor,  
wherein said forming of said trench top oxide includes depositing a doped  
trench top oxide layer above said capacitor conductor, and forming an undoped  
trench top oxide layer above said doped trench top oxide layer.

- [c19] The method in claim 18, further comprising depositing a conductive node strap  
in said trench adjacent said capacitor conductor.
- [c20] The method in claim 18, further comprising heating said structure to form a  
conductive buried strap in said substrate adjacent said trench top oxide.
- [c21] The method in claim 18, wherein said process of depositing said doped trench  
top oxide layer comprises a high density plasma-chemical vapor deposition  
process.
- [c22] The method in claim 18, wherein during said process of depositing said doped  
trench top oxide layer a percentage by weight of dopant in said doped trench  
top oxide layer is less than 1%.